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A qualitative study exploring women's health behaviours after a pregnancy with gestational diabetes to inform the development of a diabetes prevention strategy

<SHORT TITLE: Women's health behaviours after gestational diabetes>

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What's new?

- This qualitative study exploring the diverse experiences of 50 women with previous gestational diabetes found that pregnancy experience had a potentially significant impact on maternal diet- and care-seeking behaviours after birth.
- Lack of medical follow-up after pregnancy reinforced the view that women's health is unimportant, and failed to capitalize on positive changes to health behaviour made during pregnancy.
- Interventions to help prevent future diabetes in this population should address emotional stress, convey personalized risk, adopt a family-centred approach, focus more on the mother's health rather than just the infant's, and be flexible with a range of resources.

Abstract

Aim To inform targeted interventions for women with gestational diabetes mellitus (GDM) by exploring the factors that influence their health behaviours and their preferences for lifestyle support.

Methods Participants were women with previous GDM taken from a diverse inner-city UK population. Data collection involved focus groups (n = 35 women in six groups) and semi-structured interviews (n = 15 women). The transcribed data were analysed using framework analysis.

Results Eight themes relating to factors influencing health behaviour were identified: psychological legacy of pregnancy, relationships with healthcare professionals, physical impacts of pregnancy, social support and cultural norms, life-scheduling, understanding and risk perception, appetite regulation, and prioritization of the baby. The women's recommendations for intervention components included addressing the emotional stress of pregnancy; conveying personalized risk in a motivational way, adopting a family-centered approach, focusing on women's health rather than just the infant's, and developing flexible interventions. These recommendations were used to construct a model integrating the behaviour-regulating factors with a suggested framework for intervention.

Conclusions This study identified some common drivers that may regulate the health behaviours of women following GDM, and recognized some ways to improve care to impact on this. Interventions for diabetes prevention in this population need to address factors at both the individual and systemic levels.

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<H1>Introduction

Gestational diabetes mellitus (GDM) is a common condition affecting up to one in 20 pregnancies [1], and its incidence is increasing [2]. Women with GDM have an increased risk of adverse fetal, infant and maternal pregnancy outcomes [3], further episodes of GDM [4], and are seven times more likely to develop Type 2 diabetes than women without GDM [5]. While lifestyle interventions can help to delay or prevent Type 2 diabetes in high risk populations [6], there is still uncertainty as to what would be an optimal strategy for this group.

GDM management involves an intensive approach of reducing blood glucose to improve pregnancy outcomes, requiring women to make rapid and radical behavioural changes including reducing or altering carbohydrate consumption, increasing physical activity, monitoring blood glucose, and taking diabetes medications [7-9]. Previous studies have shown that while most women with GDM are motivated to adopt these behaviours in pregnancy for the benefit of their unborn child [10-12], the motivation to sustain positive lifestyle behaviours after birth is often lost [11,13]. Therefore, understanding the factors that influence women's behaviours during and after GDM may help inform more targeted diabetes prevention interventions for this population. As the antenatal and postpartum periods involve physical, psychological and social changes [13], it is also important to develop interventions that are acceptable and useful to women in the context of these changes. In this paper, findings from a study that explored factors that influence women's health behaviours after GDM, and their preferences for lifestyle support to reduce diabetes risk, are presented.

<H1>Participants and Methods

The study followed a qualitative design using in-depth interviews and focus groups, as previously described [14]. Participants were recruited through a large teaching hospital in London, UK, which supports a diverse set of people. All women diagnosed with GDM in the area are referred to and managed in the hospital's diabetes pregnancy clinic. Participants were purposively sampled based on BMI, ethnicity and area level deprivation scores (derived from the Index of Multiple Deprivation, which ranks small areas based on income, employment, education, health, crime, housing and environment) using the following eligibility criteria: diagnosis of GDM within the previous five years (modified WHO criteria) [15], aged ≥ 18 years, able to speak and understand English, and BMI ≥ 25

kg/m² (or ≥ 22 kg/m² if Asian). Previous pilot focus groups demonstrated that participants with a lower BMI had different health and lifestyle concerns, and were therefore excluded from this study.

Participants were sent an invitation letter and participant information sheet and then phoned by a researcher (KS), who responded to questions and recruited participants to either focus groups or interviews, depending on their preferences. The sample size was determined using the concept of information power. Based on the criteria described in Malterud *et al.* [16], a sample size of 20 (where each focus group counts as one item) was decided upon, with the aim of having 6–8 participants in each focus group. Over-recruitment took place to take into account potential drop-out. Data saturation was not a criterion for sample size, as framework analysis was used rather than a grounded theory approach. However, it was expected that data concordance of the main themes would be achieved with this sample size.

The focus groups were conducted by two female researchers (JP, a doctoral research fellow, and KS, a research assistant) who had prior experience of conducting interviews and focus groups, and each lasted 60–120 min. The focus groups took place in non-clinical meeting rooms on the hospital site. The interviews were conducted by one researcher (JP) in a setting of the participant's choice (home [n = 5], non-clinical meeting room [n = 2], workplace [n = 1] or by phone [n = 7]), and each lasted 20–120 min. The researchers introduced themselves and provided brief information about their job roles at the beginning of the interviews and focus groups. Participants were invited to bring their children with them to ensure no potential participant was excluded on this basis. Both the interviews and focus groups followed a topic guide that aimed to elicit the women's experiences and their views on lifestyle support, and brief field notes were made by the researchers. Pilot interviews and focus groups had been conducted previously to inform the topic guide (Fig. 1).

Participants were given a £10 voucher for their involvement. They were not given the transcripts for feedback, nor were repeat interviews conducted. However, they were given the opportunity to be involved in a group to consider the study findings to inform the development of an intervention for women with GDM. Ethical approval for the study was granted by the UK National Research Ethics Service (reference 13/SW/0141).

As described elsewhere [14], the interviews and focus groups were digitally recorded, transcribed verbatim and imported into NVivo version 10 for analysis using the framework approach, which defines a structured and systematic process for categorizing and organizing [17]. Two researchers (JP and KS) independently coded all the transcripts and a third researcher (AF) coded a subsection of transcripts. Themes were derived iteratively from the data rather than previously defined, through the following five-step approach:

- (i) familiarisation – JP and KS repeatedly read the transcripts;
- (ii) identifying a thematic framework – a selection of transcripts were independently coded by JP, KS and AF, who then met to discuss the codes, resulting in an initial thematic framework;
- (iii) coding/indexing – the framework was systematically and independently applied to the transcripts by JP and KS, who met frequently to discuss discrepancies. The codes were moderated by AF who addressed any uncertainties;
- (iv) charting – framework matrices were created in NVivo for each theme to which the data was entered; and
- (v) mapping and interpretation – the data was transferred to a table for each theme. Data was grouped and key dimensions [17], which became the main themes of the results, were identified.

<H1>Results

The researchers were able to contact 118 of the 536 women who met the inclusion criteria, of whom 78 agreed to participate. The reasons for nonparticipation were: unavailability on the dates offered (n = 9), not interested (n = 8), requesting more information but uncontactable later (n = 7), did not meet the inclusion criteria (n = 7), overseas (n = 2), too busy (n = 2), still angry about care received (n = 1), subsequently diagnosed with Type 1 diabetes (n = 1), and long-term illness (n = 1). Fifty women participated in the study, and 28 women did not attend their interview or focus group. Participants' children were present at five of the six focus groups, and at four of the eight face-to-face interviews. Participants were representative of the local population in terms of age, ethnicity, BMI and area deprivation rank. A higher proportion of the sample population were primiparous than the clinic population (31% compared with 17%). Participant and sample population characteristics are given in Table 1. Individual participant characteristics are given in Table 2.

<H2>Factors influencing women's health behaviours after a pregnancy with GDM

Women's health behaviours after pregnancy varied greatly. While some women reported making an effort to eat healthily, exercise, and access diabetes screening, other women described binge-eating, avoiding contact with diabetes services, and not exercising. Eight main themes expressing the factors influencing these behaviours were identified. These themes follow with supporting data from participants.

<H3>Psychological legacy of pregnancy

Women's experiences of their pregnancy often had a lasting psychological impact and influenced health behaviours after the birth. Many women identified the emotional experience of GDM as impacting negatively on their postpartum health behaviour:

'I think there was a lot of guilt. I felt as if it was my fault that I was in this situation...I just felt like...what have I done to my baby...I remember my husband saying, "You have to try and carry on doing that [diet] so that you don't keep getting gestational diabetes every time you have a baby", but it's so hard, because every time I tried to, like, eat the same way, it just reminded me of that time and so I just, kind of, pretended I didn't have it.' (Focus Group 3)

The experience of adhering to strict dietary demands during pregnancy often resulted in women rebelling against this regime once they had given birth, as they perceived it as a negative, even punitive, emotional experience:

'Even though I took care of myself during the pregnancy, as soon as she [the baby] was out I was just like, "Carbs!" and I just went nuts and had sweets and chocolates and everything and I could not stop myself! I tried really really hard but I just couldn't, because I'd just been deprived for like eight months.' (Focus Group 6)

<H3>Relationships with healthcare providers

Women's interactions with clinicians during their pregnancy shaped their behaviour after the birth, in particular their engagement with postpartum follow-up. Most women reported receiving good pregnancy care, and believed the personal relationship they had with clinicians helped them maintain ongoing healthy behaviours:

'For me I think the single biggest help was an amazing doctor who came and did my last test and said "OK, listen, you're fine now, but there is a 50% chance that you will develop Type 2 within the next 10 years". Just having somebody on a really personal level just saying, "Look you can be fine but there is a 50% chance..." It was lovely, you know, he cared.' (Focus Group 1)

Conversely, some women perceived the care they received as heavy-handed or fear-inducing, which resulted in disengagement with services:

‘They [the clinicians] just kind of come down on you like a ton of bricks...I feel like I probably could do with having my HbA_{1c} tested...I suppose because I had so much of it during my pregnancy; all this, you know, “You’ve got to do this”, “This is going to happen to you”, “This is going to happen to you”, and the kind of heavy-handed approach has never really worked for me...I didn’t even go for my glucose tolerance test. I ripped it up, you know. So it had the opposite effect on me...even though it’s in the back of my mind I’m thinking, oh you need to get on top of this, I’ve put weight on...but I didn’t really want anything to do with [the hospital]...if you’ve had a bad experience during your pregnancy, then you felt like you hadn’t had the support that you needed, then why are you going to think all of a sudden, oh I’ll go and get support now?’ (Focus Group 5)

Another feature of their interactions with clinicians was the sense of abandonment women felt following the intense care they received during pregnancy. This made it harder for them to keep on track with a healthy lifestyle:

‘Nobody’s calling me for anything, so that’s why I’m sitting down at home. It’s not really helpful, working this out on your own.’ (Participant 6)

<H3>Physical impacts of pregnancy

Women sometimes suffered problems related to their pregnancy that made physical activity difficult after the birth, such as recovering from a caesarean section, hip problems, and other health issues acquired during or after pregnancy.

‘I’m trying to lose weight but it’s difficult because I can’t mobilize. There’s whole other issues that I had with the hyperemesis and due to pregnancy.’ (Participant 13)

<H3>Social support and cultural norms

Social interactions with family and friends had a strong mediating effect on health behaviours. Support, encouragement and understanding from family members, friends and colleagues were key facilitators of healthy behaviours, both during and after pregnancy. For some women, involving their partner was perceived as helpful, although for others it was not:

‘My husband nags me all the time to make sure I eat healthy...To lose weight I know that I need someone to nag me.’ (Participant 11)

‘If my husband says anything about me eating something, that just makes me really aggressive. I just don’t find that helpful.’ (Focus Group 1)

Cultural norms and the social or familial environment could make healthy eating difficult. Participants sometimes felt that dietary advice from clinicians conflicted with eating norms or responsibilities such as cooking for the wider family. This resulted in them not adhering to dietary advice:

‘We Jamaica, we don’t like too much salad and those things...I can’t eat veg every day like a lot of people, especially white [people].’ (Participant 9)

‘They’re [women with GDM] probably cooking for families and stuff like that. They don’t want to maybe change their whole diet. It has to be workable.’ (Participant 2)

Women also received additional advice from family members about diet, exercise, their disease risk and baby care both during and after pregnancy that contradicted the medical advice they had been given. This could be confusing for some women and resulted in them ignoring medical advice:

‘I had all this conflicting advice from one culture that’s like “Yeah, everybody gets this [GDM] and it’s fine, don’t worry about it” and then the other side where it’s like “No, this is what it’s like for your baby” ...and I remember feeling so torn: Should I take the medication? And I decided not to take it and then when he [the baby] ended up in special care I was like, “It’s because I didn’t take the medication!”, and it was a horrible, horrible time.’ (Focus Group 3)

<H3>Life-scheduling

Participants faced obstacles to healthy eating and exercise after the birth, such as a lack of time, childcare responsibilities, financial constraints and fatigue:

‘I’m not able to dedicate time exclusively for exercise because I work full-time and then when I go home it’s like my child, baby time.’ (Participant 14)

‘People tell people to eat healthily, but when you’re a mum and you’re busy and you’ve got the school run and you’ve got a new-born and you’re like juggling everything, you really don’t have time. You end up snacking and eating the children’s leftovers.’ (Participant 13)

‘I am not working and I don’t have money to go to a gym.’ (Participant 3)

‘By the time you finish you will be exhausted, worn out. So I can't actually, you know, go for sport activity.’ (Participant 6)

Conversely, sometimes having children was seen as a facilitator of greater activity.

‘Because I’ve got the buggy it’s actually easier to walk than it is to get on the bus.’ (Focus Group 4)

<H3>Understanding and risk perception of developing Type 2 diabetes

The women expressed a wide range of understanding about how health behaviours might impact their diabetes risk. Some women did not know they were at risk of developing Type 2 diabetes, and therefore returned to their usual eating habits after birth because their GDM had resolved:

‘And then when you have another check-up, I found I am not diabetic, 100%. I open the fridge and there was no cake, because when I was pregnant I would not eat it, and so I bought one, very big. I put it in the fridge, because I am not diabetic.’ (Focus Group 1)

Indeed, some did not know they were at an increased risk of developing future diabetes:

‘If you [the interviewer] hadn’t done it, nobody would ever have called us back and we would never have known that we could get it [diabetes] later on in life.’ (Focus Group 2)

Others did know about the diabetes risk, but felt that they needed more specific information about their individual risk in order to decide if they would make changes:

‘What is the risk? I literally don’t know. Everyone keeps saying, “There’s a risk of you having later diabetes”. Is it any higher than I was ever at risk, coz my dad had it? Is it like you’re 50% more likely to get diabetes now? OK, well that sounds quite high maybe I’ll jump into action. Or, you’re only a little bit more at risk than anyone else, you know? Me as an individual rather than just being told standard NHS fear factors.’ (Participant 1)

Having an understanding of the extent to which diet and exercise impacted on risk also influenced women's decisions on behavioural change.

'You have to want to make sure that you're reducing risk factors to actually make a difference.' (Participant 11)

The women reported a range of different risk perceptions for diabetes that were often related to their familial experiences of diabetes or factors in their cultural context. Many women had a family history of diabetes. For some this was a driver for health-attending behaviours, although for others it caused fear, which prompted avoidance behaviours:

'Because I have a strong diabetes background in my family, so I'm really worried about it...so that keeps me in track.' (Participant 14)

'I have actually been invited a few times [for an HbA_{1c} test] but I just haven't gone, for fear that I might get told that I am diabetic.' (Focus Group 1)

The ubiquity of diabetes within the family or cultural context did not always prompt fear, but sometimes normalized the disease and resulted in either a perception of lack of severity, or a fatalistic attitude.

'I am from Argentina, and my husband is from Algeria, so for everybody else in my country or in Algeria it is normal to have high sugar. So they say, "Oh it's fine you have high sugar, it's normal. Nothing is going to happen to you or to your baby more than the weight of the baby being too big"...So you don't realize how much in danger your baby can be or how that can affect your baby.' (Focus Group 1)

While low-risk perception for some women meant that they returned to eating as they had done prior to pregnancy, there was no indication that having a high-risk perception consistently resulted in women adopting or maintaining healthy eating and activity habits, and the factors influencing behaviours were different for each participant.

<H3>Appetite regulation

Participants discussed their difficulties with appetite regulation, impeding their ability to adhere to a healthy diet as they struggled to overcome hunger or habit.

‘So that's why I said we Africans, we don't tend to [limit] the portions ourselves but then maybe something happens, then you have to follow the protocol, all the way. People postpone – “I will start next week” - and then it goes on and on.’ (Participant 6)

‘I didn't used to eat sugar or sweets, I didn't like it. But now, I can't resist it!’ (Focus Group 2)

In addition, women found that breastfeeding also made appetite regulation more challenging.

‘After I breastfed my daughter two years full I was fat, because I ate a lot...I am thinking maybe I don't have milk to breastfeed my daughter.’ (Focus Group 1)

<H3>Prioritization of the baby after birth

Women reported that healthy eating, exercise, and reducing the risk of diabetes were not the priority after having a baby; their lives were dominated by childcare.

‘I think everyone knows you put weight on when you have a child, you need to lose weight after. Your priority is your baby afterwards so I don't think you kind of pay mind to that...I think afterwards obviously you're quite overwhelmed. You've got a new-born baby, it's crazy, you're in between nappies, feeds, baby, and then your other children as well.’ (Participant 13)

Women also described feeling selfish at taking time to focus on themselves rather than their baby.

‘During the week, on my days with my daughter, again my time is sacred...so I don't want to do something – well, I feel it's selfish of me to do something just for myself.’ (Participant 11)

They also expressed an active lack of care for themselves during the postpartum period, due to the preoccupation with the new baby.

‘The first three months is about your baby and...you’re completely preoccupied with that. I mean, God, someone could cut off your right foot, you know, it’d be fine.’ (Participant 1)

<H2>Preferences for lifestyle support

Participants provided insight into their preferences for intervention type, delivery mode, and when they might be receptive to it. There was a strong consensus that some type of follow-up after pregnancy to support them with healthy eating and physical activity would be very beneficial.

‘I try; I say “I must lose weight, I just have to”. Because now that I have had gestational diabetes I know that there is a possibility that I will have Type 2 in the future so I have to watch...When you have the baby there is no support on how you lose weight and all that stuff. That’s very important. If you had that it would really help.’ (Focus Group 1)

Overall, participants thought that approaches to postpartum lifestyle support should be individualized, reflective of their varying needs before and after birth, nonjudgmental, and involve interaction with other women with GDM. While views on the optimal time to commence intervention varied, the majority of participants thought that two or three months after birth was ideal. The participants discussed a range of potential delivery modes, as well as possible content (Table 3).

<H1>Discussion

This study identified a number of factors that may influence women’s health behaviours after GDM. Many of those factors reflect findings from previous studies, such as the prioritization of family over self [11,18,19], lack of time and fatigue [19,20], fear of diabetes [21,22], financial constraints [19,23], childcare demands [11,13,20], social support [23-25], conflicting cultural expectations, and the emotional stress of GDM [22,26]. However, in addition, the current study highlights that the pregnancy experience itself can have a significant determining effect on future health behaviours. The medicalization and necessary stringency of lifestyle restrictions during pregnancy have a potentially negative impact on the patient-provider relationship, making women feel pressurized and resulting in aversive postpartum behaviours. Tierney *et al.*[19] hypothesize that the paternalistic model of care received by women with GDM reduces women’s capacity to take responsibility for their own behaviour, therefore further negatively impacting long-term health-attending behaviour. This emphasizes the importance of promoting patient ownership, and suggests the need for an open conversation about what approach works best for individual women. It also highlights the need to address the emotional aspects of GDM. However, any change in approach would need to be balanced against the good pregnancy outcomes that the current model produces.

A key barrier to health-attending behaviour after birth was prioritization of the baby above the women's own health needs. Other studies also show that health-attending behaviour during pregnancy is strongly motivated by the welfare of the baby, and therefore women largely revert to previous health behaviours after birth [11]. This prioritization is reflective not only of the focus of the care provider during pregnancy, but also of wider societal views on motherhood. Therefore, the importance of the woman's own health should be emphasized more both in the ante- and postnatal periods.

Similar to a previous systematic review [27], it was found that while many women knew of their diabetes risk, there was a knowledge-behaviour gap. In the current study a family history of diabetes resulted in either normalization, and therefore a reduction in risk perception, or fear. Fear prompted health-attending behaviour in some yet avoidance behaviour in others. These variations suggest that risk responses are very individual, emphasizing the need to address and explain risk in an individualized way that considers the interplay between the woman's personal beliefs and her socio-cultural context. There was no obvious association between health behaviours and demographic characteristics. It may be useful to consider these associations in an observational study with a larger sample, alongside other underlying psychosocial traits, to see what factors might shape risk perceptions and reactions in women with GDM. Within this study, cultural and social contexts could not be generalized to demographic groups, as the interplay between these factors resulted in very different circumstances for each individual.

In terms of women's preferences for lifestyle support after pregnancy, a significant factor was the need to build on lifestyle changes made during pregnancy. Unfortunately, similar to previous studies [28], it was observed that women felt unsupported after their pregnancy, indicating a lost opportunity for intervention. These findings were also congruent with other research in relaying women's desire for increased follow-up after birth with more specific individualized lifestyle support [11,19,27]. While the findings showed a wide range of views on the means of delivery and content for a preventative intervention, there were some unifying themes, which included plurality of provision, localization of content/delivery and connectivity with socio-cultural habitus, interaction with peers, and timely information on personal risk. The potential use of electronic health (eHealth) and mobile health (mHealth) strategies were also identified, and although some women suggested limitations with these media, the majority considered them a potentially useful resource for delivering information, helping them manage behavioural goals, and enabling interaction with other women who had experienced GDM [19]. eHealth and mHealth strategies may also offer a more pragmatic approach to addressing some of the identified needs in the context of an NHS with limited capacity to provide truly individualized face-to-face care. There were differing views on the timing and frequency of contact, which further emphasizes the need to tailor interventions and provide choice.

In summary, this study has highlighted some important factors to be considered in the development of diabetes prevention interventions for this population. Firstly, the importance of attending to the emotional and psychological stress experienced by women during GDM, as this can negatively affect future health behaviours. Secondly, the study emphasizes the value of building diabetes prevention interventions with the momentum gained in the pregnancy, which indicates a need for the clinicians to focus more on the women's own health both during and after pregnancy. Thirdly, there is a need to use flexible models that can be individualized to women's needs and socio-cultural contexts. Such models need to attend to the transitions occurring in pregnancy and the postpartum period, and incorporate a family-centered approach. Fourthly, there is need to convey the meaning of diabetes risk in a motivational way. Finally, women want to access self-help resources and connect with other women through a variety of interventional formats and media which are adaptable to the multiple demands on their time. The underlying drivers for women's behaviours with their ideas for supportive intervention are integrated into an interventional framework (Fig. 2).

<H2>Study strengths and limitations

As with similar studies, this study is open to selection bias, although it was attempted to mitigate this to an extent by offering both interviews and focus groups in varied settings. It should also be noted that the views expressed by participants on particular ethnic groups may be specific to that individual only. While the findings of this study are limited to its context, the population with GDM is large and diverse, and is typical of many urban areas. Furthermore, the theoretical interpretation is expressed non-contextually such that the interpretation could be translated and explored in other care contexts.

In conclusion, this study has identified some common drivers that may regulate the health behaviours of women following GDM. The women's experiences indicate that, while current care achieves good clinical pregnancy outcomes, there is scope to improve its impact on future health behaviours, and postpartum follow-up is lacking. Given that most women are receptive to ongoing support and feel abandoned post-pregnancy, this appears to be a missed opportunity. The data indicates that women are open to interventions that are individualized, address their psychological needs, and match their changing life contexts in a family-centered way.

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Competing interests

The authors declare that they have no conflict of interests.

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Table 1 Demographic characteristics of participants compared with the clinic population

	Participants	Clinic population
Age		
Mean (years) (SD)	37.7 (6.3)	36.5 (5.6)
Ethnic group*		
Black / African / Caribbean / Black British	25 (50%)	289 (54%)
White	13 (26%)	145 (27%)
Asian / Asian British	9 (18%)	75 (14%)
Mixed / Multiple ethnic groups	3 (6%)	11 (2%)
Other ethnic group	0 (0%)	11 (2%)
BMI		
Mean (kg/m ²) (SD)	34.7 (6.6)	33.0 (6.8)
Index of Multiple Deprivation rank**		
Median (range)	9,399 (1,596 – 21,202)	7,422 (1,145-32,003)
Parity		
Mean (SD)	2.2 (1.2)	1.4 (1.3)
Primiparous (%)	31%	17%

*Ethnic groups are defined as follows based on the UK Office for National Statistics groups:

Black / African / Caribbean / Black British – African, Caribbean, any other Black/African/Caribbean background; White – English/Welsh/Scottish/Northern Irish/British, Irish, Gypsy or Irish Traveller, any other White background; Asian / Asian British – Indian, Pakistani, Bangladeshi, Chinese, any other Asian background; Mixed / Multiple ethnic groups - White and Black Caribbean, White and Black African, White and Asian, any other Mixed/Multiple ethnic background; Other ethnic group – Arab, any other ethnic group.

** Index of Multiple Deprivation ranks every small area in England from 1 (most deprived area) to 32 844 (least deprived area).

Table 2 Demographic characteristics of individual participants

Focus group	Number of participants	Median age in years (range)	Ethnic group*	Index of Multiple Deprivation rank**	Median time since pregnancy in months (range)
Focus group 1	10	37.5 (27-45)	Black / African / Caribbean / Black British (5) White (3) Asian / Asian British (2)	Lowest 10% (1) Lowest 10-20% (4) Lowest 20-30% (4) Lowest 30-40% (1)	20 (6-44)
Focus group 2	7	40 (37-42)	White (3) Black / African / Caribbean / Black British (2) Asian / Asian British (1) Mixed / Multiple ethnic groups (1)	Lowest 10-20% (2) Lowest 20-30% (4) Lowest 30-40% (1)	20 (7-42)
Focus group 3	7	30 (21-44)	Black / African / Caribbean / Black British (3) White (3) Asian / Asian British (1)	Lowest 10-20% (3) Lowest 20-30% (4)	11 (7-30)
Focus group 4	4	39.5 (36-43)	Black / African / Caribbean / Black British (3) Asian / Asian British (1)	Lowest 10-20% (1) Lowest 20-30% (1) Lowest 30-40% (2)	16 (13-20)
Focus group 5	4	37 (33-43)	White (2) Black / African / Caribbean / Black British (1) Mixed / Multiple ethnic groups (1)	Lowest 10-20% (1) Lowest 20-30% (1) Lowest 40-50% (2)	12.5 (9-16)
Focus group 6	3	33 (30-36)	Black / African / Caribbean / Black British (3)	Lowest 10-20% (2) Lowest 40-50% (1)	12 (9-33)
Interviews					
	Mode or place of interview	Age (years)	Ethnic group*	Index of Multiple Deprivation rank**	Time since pregnancy (months)
Participant 1	Phone	39	White British	Lowest 30-40%	19
Participant 2	Phone	43	Black British	Lowest 20-30%	14
Participant 3	Phone	49	Black African	Lowest 30-40%	27
Participant 4	Home	34	Black African	Lowest 30-40%	16
Participant 5	Home	42	Black African	Lowest 20-30%	40
Participant 6	Phone	43	Black British	Lowest 20-30%	20
Participant 8	Hospital	46	Black African	Lowest 10-20%	14
Participant 9	Home	44	Black Caribbean	Lowest 20-30%	29
Participant 10	Phone	40	Black British	Lowest 20-30%	50
Participant 11	Phone	34	Indian	Lowest 50-60%	17
Participant 12	Phone	53	Other Asian background	Lowest 40-50%	25
Participant 13	Home	28	Other Mixed / Multiple ethnic background	Lowest 10%	38
Participant 14	Hospital	33	Other Asian background	Lowest 10%	20
Participant 15	Workplace	49	Other White background	Lowest 10-20%	27
Participant 16	Home	39	Other Asian background	Lowest 60-70%	10

*Ethnic groups are defined as follows based on the UK Office for National Statistics groups:

Black / African / Caribbean / Black British – African, Caribbean, any other Black/African/Caribbean background; White – English/Welsh/Scottish/Northern Irish/British, Irish, Gypsy or Irish Traveller, any other White background); Asian / Asian

British – Indian, Pakistani, Bangladeshi, Chinese, any other Asian background; Mixed / Multiple ethnic groups - White and Black Caribbean, White and Black African, White and Asian, any other Mixed/Multiple ethnic background; **Other ethnic group** – Arab, any other ethnic group.

** Index of Multiple Deprivation ranks every small area in England from 1 (most deprived area) to 32 844 (least deprived area).

Table 3 Pros and cons of preventative intervention approaches identified by participants

Mode of delivery	Pros/Cons	Comments and suggestions from participants
Group sessions	Pros: <ul style="list-style-type: none"> • Peer support • Socializing Cons: <ul style="list-style-type: none"> • Big investment for NHS • High drop-out rate 	<ul style="list-style-type: none"> • A drop-in support group during pregnancy would be helpful • Content should include: getting weighed; glucose monitoring; and cooking and exercise classes • There is a need for one-to-one sessions pre-group • Groups need to be local, informal, provide an activity for children or childcare, and involve women with current or previous GDM in running the groups
One-to-one sessions	Pros: <ul style="list-style-type: none"> • Individualization of support and a personal plan • Continuity of care Cons: <ul style="list-style-type: none"> • Time commitment 	<ul style="list-style-type: none"> • The focus should be on developing personalized lifestyle plans for eating and activity • Specific resources targeted to needs on healthy eating and activity • Sessions need to be delivered by someone with specialist GDM knowledge: dieticians, diabetes team members, a dedicated GDM nurse, or a midwife • Contact with or input from other women with GDM is important • Start sessions post-diagnosis focusing on emotional adjustment to GDM and lifestyle support. These should continue postpartum starting around three months post-birth • Frequency recommendations varied from 1–12 months • Sessions should be supplemented with tele-support for follow-up contact to see how progressing. • A supportive nonjudgmental approach.
E/M-health support systems	Pros: <ul style="list-style-type: none"> • Ease of access • Interact with other women with GDM • Feedback messages Cons: <ul style="list-style-type: none"> • Limited access to technology 	<p>Websites</p> <ul style="list-style-type: none"> • Women were generally familiar with and utilize web-based resources for health information (e.g. mumsnet) • Women prefer simple formats with lifestyle information resources/tips, a help contact and a discussion forum for exchanging ideas • Formats need to be interactive and include scope for peer support • There should be the capacity to personalize the web environment, creating their own profiles • Women expressed a preference for mobile phone applications over written and purely web-based material <p>Text messages</p> <ul style="list-style-type: none"> • Text messages are useful as follow-up, reminders, cues to action, offering tips/resources or feedback. It is better if these are individualized rather than automated • Preferences for frequency ranged from weekly text messages to once a year <p>Phone apps</p> <ul style="list-style-type: none"> • There were mixed views on using phone apps • Popular features of phone apps included food

		<p>diaries, calorie information, inputting weight resulting in a graph, linking the app to motivational text messages, blood glucose monitoring (during pregnancy)</p> <ul style="list-style-type: none"> • There were mixed views about pedometer apps
Written information	<p>Pros:</p> <ul style="list-style-type: none"> • Something you can reflect back on <p>Cons:</p> <ul style="list-style-type: none"> • Too generic • Most do not read them 	<ul style="list-style-type: none"> • Provide leaflet early on in pregnancy warning of the risk of GDM and the importance of healthy eating throughout pregnancy • Provide a leaflet for family members on GDM and diabetes • Provide information at birth on GDM, diabetes and what happens next • Information should be personalized as much as possible • Meal planners and recipe cards are helpful

Figure 1 Summarized interview and focus group topic guide

1. Experiences of gestational diabetes
Aim: to find out participants' experiences of gestational diabetes
2. Pregnancy support
Aim: to identify what kind of support participants would find helpful during pregnancy to manage their gestational diabetes and future diabetes risk
3. Post-pregnancy support
Aim: to identify what kind of support participants would find helpful in the initial postpartum period to help reduce their risk of future diabetes
4. Post-infancy support
Aim: to identify what kind of support participants would find helpful in the post infancy period to help reduce their risk of future diabetes
5. Prioritizing support
Aim: to identify priority elements of support to help reduce the risk of future diabetes

Figure 2 Suggested approaches for lifestyle interventions to help prevent Type 2 diabetes

